Docket No.: 044084-0468 PATENT

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PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	:	Customer Number: 20277
Hiroki YOSHIDA	:	Confirmation Number: 9613
Application No.: 09/630,572	:	Tech Center Art Unit: 2625
Filed: August 03, 2000	:	Examiner: Baker, Charlotte M.

For: IMAGE PROCESSING APPARATUS AND METHOD

RESPONSE TO NOTICE OF NON-COMPLIANT APPEAL BRIEF

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith is a Corrected Appeal Brief in response to the Notice of Non-Complaint Appeal Brief dated November 21, 2006. Appellant has added the last two Appendices to the Appeal Brief indicating "NONE" for each since there is no evidence or related proceedings as defined in the Rules 41.37(c)(1)(ix) and (c)(1)(x) in the appealed case. However, the Rules do not prescribe that an indication of "NONE" is required if there is no evidence or related proceedings. If the Office intends to make this a requirement, then the Rules should be amended accordingly to put the public on notice.

Respectfully submitted,
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Please recognize our Customer No. 20277 as our correspondence address.

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Application No.: 09/630,572	:	Tech Center Art Unit: 2625
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CORRECTED APPEAL BRIEF

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed September 18, 2006, wherein Appellant appeals from the Primary Examiner's rejection of claims 1-9 and 11.

Real Party In Interest

This application is assigned to Minolta Co.,Ltd. by assignment recorded on August 3, 2000, at Reel 10991, Frame 0231.

Related Appeals and Interferences

There are no related appeals and interferences associated with the above-referenced patent application.

Status of Claims

Claims 1-9 and 11 are pending in this application and are under final rejection. Claim 10 was previously cancelled and is no longer pending.

Status of Amendments

All amendments have been entered, including an amendment after final submitted on July 3, 2006, wherein claim was amended. The Examiner did not indicate in the Advisory Action dated July 24, 2006 that the amendment to claim 4 was denied entry.

Summary of Claimed Subject Matter

The invention is directed to digital image edge enhancement by determining the position of an edge of a target pixel, selecting a filter matrix corresponding to the position of the edge of the target pixel, calculating data for the target pixel and the pixels surrounding the target pixel using the weighting matrix depending on the position of the edge, and determining a range for edge enhancement using the calculated data, and enhancing the pixels within the enhancement range (specification: p. 3, lines 5-21), The claimed subject matter is directed to an image processing apparatus (claims 1-6 and 11), an image processing method (claims 7 and 8), and a medium readable by computer (claim 9).

Claims 1-6 and 11 are directed to an image processing apparatus. Claims 1 and 11 are independent claims. The apparatus of claim 1 comprises (i) edge detecting means for determining the presence/absence of an edge at each pixel of input data and detecting a position of the edge at each edge pixel, (ii) a selecting means for selecting a weighting matrix

corresponding to the position of the edge of each target pixel determined to have an edge by said edge detecting means; (iii) <u>an enhancement range determining means</u> for determining, using said weighting matrix, a range of edge enhancement of each said target pixel determined to have an edge; and (iv) <u>an edge enhancing means</u> for executing an edge enhancement process on data of object pixels within the enhancement range determined by said enhancement range determining means (specification: p. 3, lines 5-21; p.8, line 18 to p. 10, line 4; Figs. 6-10). The apparatus of independent claim 11 is similar to claim 1, and comprises an edge detector, a selector for selecting a weighting matrix corresponding to the position of the edge of each target pixel determined to have an edge by said edge detecting means; and a controller configured to (i) determine, using said weighting matrix, the range of edge enhancement of each said target pixel determined to have an edge and (ii) to execute an edge enhancement process (specification: p. 8, line 6 to p.13, line 4 ; Fig. 3)

Claims 2-6 are dependent on claim 1. Claim 2 further limits the enhancement range determining means of claim 1 to require that the means increases the weighting of components corresponding to the interior side of the edge in the weighting matrix (specification: p. 4, lines 10-13). Claim 3 further limits claim 1 to require that the edge detecting means determines the edge to be between pixels (specification: p. 8, line 18 to p. 10, line 6). Claim 4 further limits claim 1 to require that the selecting means selects the weighting matrix based on the presence/absence of an edge in four directions surrounding the target pixel (specification: p. 4, lines 14-17). Claim 5 further limits claim 1 to require that the edge enhancing means executes processing based on the hue and chroma of the pixels surrounding the object pixel (specification: p. 4, lines 18-20). Finally, claim 6 further limits claim 1 to require that the edge enhancing

means executes processing based on the distance of the object pixel to the target pixel (specification: p. 4, lines 21-23).

Claims 7 and 8 are directed to an image processing method comprising the steps of (i) determining the presence/absence of an edge at each pixel of input image data, (ii) selecting a weighting matrix corresponding to the position of the edge for each target pixel determined to have an edge, (iii) using the weighting matrix to determine a range of edge enhancement for each target pixel determined to have an edge, and (iv) executing an edge enhancement process for the object pixels within the determined edge enhancement range (specification: p. 3, line 22 to p. 4, line 9). Claim 8 is dependent on claim 7 and further limits claim 7 to require that in step (iii) the weighting of components corresponding to the interior side of the edge in the weighting matrix is increased (specification: p. 11, lines 10-13).

Claim 9 is directed to a medium readable by a computer storing computer-executable programs (specification: p. 3, lines 21 and 22). The method comprises the steps of (i) determining the presence/absence of an edge at each pixel of input image data, (ii) selecting a weighting matrix corresponding to the position of the edge for each target pixel determined to have an edge, (iii) using said weighting matrix to determine a range of edge enhancement for each said target pixel determined to have an edge, (v) and (iv) executing an edge enhancement process for the object pixels within the determined edge enhancement range (specification: p. 3, line 22 to p. 4, line 9).

Grounds of Rejection To Be Reviewed By Appeal

Claims 1-9 and 11 stand rejected under 35 U.S.C. § 102(e) as being anticipated Kuwata et al. (U.S. Patent No. 6,392,759).

Argument

Claim 1 requires an "edge detecting means for determining the presence/absence of an edge at each pixel of input data and detecting a position of the edge at each edge pixel." The Examiner finds support for this feature of the invention at Fig. 1 and at col. 9, line, 65 to col. 10, line. 4 and at col. 10, line 5-12 of Kuwata et al. Fig. 1 of Kuwata et al. discloses an image obtaining unit, a summation processing unit, an edge-enhancement element determination unit and an edge enhancement unit. The Examiner has not identified which of these units is the edge detecting means for determining the presence or absence of an edge of each pixel and detecting a position of the edge. The reference at col. 9, line, 65 to col. 10, line 4 and at col. 10, line. 5-12 discloses the following:

> Assuming that the image data is composed of pixels in dot matrix, each pixels [sic, pixel] is represented by multi-level RGB luminance data. At an edge portion of the image, the difference of the luminance data between adjacent pixels is large. The difference, which is a luminance gradient, is called an edge amount. As shown in FIG. 7, edge amounts are summed up while scanning the respective pixels constituting the image.
>
> At step **S110**, the edge amount of the each pixel is judged. In case of considering an XY rectangular coordinates as shown in FIG. **8**, the vector of a image change level can be calculated by obtaining an X-axis directional component and a Y-axis directional component. In a digital image composed of pixels in dot matrix, the pixels are adjacent to each other in a vertical axial direction and a lateral axial direction as shown in FIG. **9**.

The Examiner has not explained how this disclosure teaches or discloses an edge detecting means for determining the presence or absence of an edge of each pixel and detecting a position of the edge. The Kuwata et al. disclosure describes an "edge portion" of the image and a step S110 for determining the edge amount or luminance gradients, but not of a means for detecting the presence or absence of an edge of a pixel, let alone detecting a position of the edge. The x and y parameters are not position, but vectors of an image change level. As pointed out in col. 10, lines 13-14, the "brightness of these pixels are represented by f(x,y)." The Examiner has not explained how x and y related to position as required by the claim.

In the Advisory Action the Examiner maintained that Kuwata et al. discloses the edge detecting means and relies on Fig. 1, in particular, "image processor" **20**. The "image processor," as noted *supra*, consists of four component units, none of which are disclosed to determine the presence/absence of an edge at each pixel of input data and to detect a position of the edge at each edge pixel. The Examiner's counter argument is that Appellant "does not set forth in the Specification which part of the CPU performs the edge detection ...." This argument is without merit. Appellant's specification at pages p. 8, line 11 to p. 11, line 9 discloses the steps for determining the position of the edge of the target pixel to be enhanced. On the other hand, the "image processor" is defined by Kuwata et al. as executing "image processing to perform the edge enhancement processing at a predetermined enhancement level" and "outputs the edge-enhancement processed image data to an image output device **30**" (col. 8, lines 46-52). This disclosure does not teach or suggest a step of determining the presence or absence of an edge for a pixel, let alone the position of the edge, if present, as required by claim 1.

In the Advisory Action, the Examiner contends that the above disclosure of Kuwata et al. at col. 10, lines 5-12 supports a finding that "the pixel is judged to be an edge pixel or not." As pointed out *supra*, the disclosure at col. 10 is directed to the position of the pixel, and not an edge of the pixel. The Examiner also points to col. 4, lines 28-32; col. 11, lines 3-17; and Fig. 6 to support her position. Fig. 6 illustrates Kuwata's the method steps for the summation of image edge amounts. The disclosure at cols. 4 and 11 describes summing the edge amounts with respect to only pixels having edge amounts over a threshold value. The present invention uses different filters to measure each edge of the target pixel (Figs. 5A-5D). The disclosure relied upon by the Examiner only establishes that Kuwata et al. measure only a target pixel having an edge, not each edge of the target pixel. Kuwata et al. do not determine whether the edge is above, below, to the right or to the left of the target pixel as described by Appellant's in their specification. Appellant's invention discloses determining these positions and applying different filters depending on the position of the edge in the target pixel (specification: p. 8, line 18 to p. 10, line 13).

In the Advisory Action, the Examiner maintains that Kuwata et al. disclose the position of the edge of the target pixel. The Examiner relies on Kuwata's disclosure that each edge pixel is identified by an x and y to indicate its position. The position identified is not the position of the edge, but the position of the pixel. Functions f(x) and f(y) relied upon by the Examiner indicate the directional shift of the pixel along the X and Y axis, respectively (see *infra*, col. 10, lines 24-29 of Kuwata et al.). Appellant's invention does not enhance the image by shifting pixels, but enhancing the pixels next to and peripheral to the edge of the target pixel in question (specification: p. 13, line 13 to p. 14, line 16).

For all of the foregoing reasons, the disclosure relied upon by the Examiner does not support the claimed detecting the position of the edge of the target pixel.

Claim 1 further requires "selecting means for selecting a weighting matrix corresponding to the position of the edge of each target pixel determined to have an edge by said detecting means." For this feature of the claimed invention, the Examiner relies on Figs. 1, 9 and 10, and col. 10, lines 25-47; col. 13, lines 28-37; and lines 51-63 of Kuwata et al. The Examiner has not explained how and why features in Figs. 1, 9 and 10 disclose the claimed features. As for the disclosure at cols. 10 and 13, the reference discloses the following:

> In FIG. 9, the X-directional difference value fx and the Y-directional difference value fy are represented by:
>
> $$fx = f(x+1,y) - f(xy) \qquad (2)$$
>
> $$fy = f(x,y+1) - f(xy) \qquad (3)$$
>
> Accordingly, a size g(x,y) of the vector having these components is a vector value represented by:
>
> $$[g(x,y)] = (fx^{**}2+fy^{**}2)^{**}(1/2) \qquad (4)$$
>
> The edge amount is represented by this [g(x,y)]. Note that the pixels are arranged into matrix in the vertical and lateral directions as shown in FIG. **10**, and when the central pixel is regarded as a pixel of interest, there are eight adjacent pixels. Accordingly, it may be arranged such that the differences between the pixel of interest and the respective adjacent pixels are represented by vectors, and the sum of the vectors is judged as the change level of the image. Note that it can be said that the less the number of pixels to be compared is, the less the amount of calculation is. Further, regarding the adjacent pixels arrayed in at least a linear direction, they interact with each other when the position of a pixel of interest moves.
>
> * * *
>
> On the other hand, the edge enhancement level also changes dependent on the size of the unsharp mask. In the three unsharp masks **41** to **43** having different numbers of rows and columns, as the mask is greater, the weighting with respect

> to the peripheral pixels around a pixel of interest is greater, while the weighting gradually decreases toward distant pixels. In other words, as the mask is greater, the weighting characteristic as a low-pass filter increases, and the generation of high frequency component can be made more easily in accordance with equation (8).
>
> * * *
>
> Note that in the calculation in equation (9), multiplications and additions are required for the number of cells in the unsharp mask **40**, with respect to the pixels around the pixel of interest, and the processing amount is large, accordingly, the unsharp mask is arranged so as to reduce the processing amount. In a case where the unsharp mask **40** of an appropriate size is employed, calculation is not necessarily required for all the cells. In the unsharp mask **42** having 7x7 cells in FIG. **19**, the weighting with respect to the outmost peripheral cells is "0" or "1". In case of weighting by "0", the multiplication by "0" is meaningless, while in case of weighting by "1", very low weighted results are obtained in comparison with the total cell value "632".

The Examiner has not explained what the selection means comprises in relation to Kuwata's disclosure reproduced, *surpa*. Nor has the Examiner explained how the disclosure of Kuwata et al. would have led a person having ordinary skill in the art to provide a selection <u>means for selecting a weighting matrix</u> and that <u>weighting matrix corresponds to the position of the edge</u> of a target pixel from the aforesaid disclosure. The Kuwata et al. disclosure refers to a mask having "weighting" values, but it does not disclose a means to select a matrix based on the position of the edge of the pixel as required by the claim.

In the Advisory Action, the Examiner asserts that Kuwata et al. disclose selecting a weighted image corresponding to the position of the edge of each target pixel to have an edge." Appellant's invention applies a different filter matrix depending on the position of the edge of the target pixel. Neither Appellant's filter matrix nor Appellant's weighting matrix use a symmetrical matrix, but an asymmetrical matrix , i.e., the pixels on each edge of the target pixel

in Kuwata's invention have the same weight (see Figs. 18-20 of Kuwata et al.) while Appellant does not apply the same weight to the pixels on each edge of the target pixel (see Appellant's Figs. 5A-5D and 12A-12D, see also p. 10, line 22 to p. 11, line 9 of the specification). Therefore, Kuwata et al. do not teach or suggest selecting a weighting matrix corresponding to the <u>position of the edge</u> of each target pixel as required by claim 1.

Claim 1 further requires an enhancement range determining means for determining a range of edge enhancement of each target pixel determine to have an edge. The means makes this determination using the weighting matrix. The Examiner relies on the same disclosure in Kuwata et al. as set forth in the previous paragraph as teaching the enhancement range determining means using a weighting matrix. The Examiner has not explained which unit in Fig. 1 of Kuwata et al. is the means for determining a range of edge enhancement. Fig. 14 of Kuwata et al., which describes the edge enhancement element determination unit, does not refer to using a weighting matrix based on the position of the edge of the target pixel to determine a range of edge enhancement. The Examiner relies on Equation (8) recited in the paragraph appearing at col. 12, lines. 50-67 of Kuwata et al. as disclosing "a range of edge enhancement ... of each said target pixel determined to have an edge." Specifically, the Examiner has relied upon following disclosure at col. 12, lines 50-67:

> Step **S320** is edge enhancement processing calculation. With respect to the luminance Y of each pixel before it is edge-enhanced, a luminance Y' of the edge-enhanced pixel is calculated by:
>
> $$Y = Y + \text{Eenhance} - (Y - \text{Yunsharp}) \qquad (8)$$
>
> In equation (8), "Yunsharp" indicates image data of each pixel which has been unsharp-mask processed. Next, the unsharp mask processing will be described. FIGS. **18** to **20** show unsharp masks **40** (**41** to **43**) of three different sizes. The unsharp mask **40** is utilized for integration on matrix image data, such that the

> central value "100" is used as a weight for the pixel of interest Y(x,y), and values of the unsharp mask corresponding to the peripheral pixels are used as weights for the peripheral pixels. If the unsharp mask **42** in FIG. **19** is used, the integration is made in accordance with:
>
> $$Yunsharp(x,y) = (1/632)\sum_{ij}(Mij \times Y(x+i,y+j)) \qquad (9)$$

In the above equation (9), the value "632" is a sum of weight coefficients; "Mij" indicates a weight coefficient given in a cell of the unsharp mask; "Y(x,y)" is the image data of each pixel; and "ij" indicates coordinate values in the row and column directions in the different sized unsharp masks 41 to 43 (col. 13, lines 6-13). According to Kuwata et al. at col. 13, lines 6-13, in "the different sized unsharp masks 41 to 43, the sum of weight coefficients are respectively '396', '632' and '2516'."

The Examiner has not explained how this disclosure recites that a weighting matrix is used in a means for determining the range of edge enhancement <u>of each target pixel determined to have an edge</u> as required by the claim. According to the disclosure of Kuwata et al. at col. 13, lines 28-37,

> In the three unsharp masks **41** to **43** having different numbers of rows and columns, as the mask is greater, the weighting with respect to the peripheral pixels around a pixel of interest is greater, while the weighting gradually decreases toward distant pixels. In other words, as the mask is greater, the weighting characteristic as a low-pass filter increases, and the generation of high frequency component can be made more easily in accordance with equation (8). is not directed to the edges

The Examiner has not explained how Equation (8), *supra*, in Kuwata et al. can disclose a range of edge enhancement of each target pixel determined to have an edge, when the disclosure of Kuwata et al. appears to teach away from what Applicant describes as their invention in Figs. 12A to 12D of the present specification, which do not show the weighting gradually decreasing

approximately the same in all directions from a central pixel. The Examiner has not explained where "*Y*unsharp(x,y)" fits into her calculations.

In the Advisory Action, the Examiner directs Appellant's attention to Eq. 8 in Kuwata et al. to support her position that Kuwata et al. disclose an enhancement range determining means. The Examiner gives an examples when the Eenhance value is set to 2 and 3. However, the Examiner has not explained how she determined the "0 to 2" and "0 to 3" ranges asserted as being equivalent to Appellant's claimed enhancement range.

As for claim 2, which depends from claim 1, the Examiner relies on Figs. 1 and 19 and col. 14, lines 29-63 of Kuwata et al. to show that the enhancement range determining means increases the weighting of components corresponding to the interior side of the edge in the weighting matrix. Col. 14, lines 29-63 of Kuwata et al. discloses the following:

> From the edge-enhanced luminance Y' and the unenhanced luminance Y, substitution is made as:
>
> $$\text{delta} = Y - Y' \qquad (10)$$
>
> Then it is possible to calculate converted R'G'B' from equation (10):
>
> $$\begin{aligned} R' &= R + \text{delta} \\ G' &= G + \text{delta} \\ B' &= B + \text{delta} \qquad (11) \end{aligned}$$
>
> In this calculation, the multiplication and addition become 1/3, thus the entire processing time can be reduced by 50% to 70%. Further, the converted result shows no enhanced color noise and provides improved image quality. Note that the luminance Y is not necessarily obtained with strict weighting as in equation (1). For example, the following equation (12) using a simple mean value does not produce a very large error.
>
> $$Y=(R+G+B)/3 \qquad (12)$$

> For more simplification, it may be arranged such that in equation (1), only the G component having the greatest contributing value to the luminance Y is regarded as the luminance Y. This does not always cause a large error.
>
> As described above, steps **S110** to **S150**, to sum up edge amounts so as to judge the sharpness level of the image, correspond to the summation process unit; steps **S210** to **S250**, to set a threshold value to determine edge enhancement level and to determine a pixel to be edge-enhanced, correspond to the edge-enhancement element determination unit; and steps **S310** to **S340**, to perform edge enhancement calculation on pixels to be subjected to edge enhancement processing, correspond to the edge enhancement unit. Further, the processing by a hardware device and a software program to obtain image data handled in the edge enhancement processing correspond to the image-data obtaining unit.

This disclosure makes no mention or provides not even a suggestion that the enhancement range determining means increases the weighting of components corresponding to the interior side of the edge of in the weighting matrix as required by claim 2. The Examiner has not explained how Figs. 1 and 19 are related to this feature and explained how the disclosure relied upon discloses this feature of the invention.

In the Advisory Action, the Examiner states that the "current claim language can be interpreted as an increase in both sides (interior and exterior), so suppose a (interior side) and b(exterior side) are both increased, this would include a (interior side) and would meet the claimed invention." The claim is clear. It is directed only the interior edge. The Examiner has not explained how she arrived at her conclusory statement the claimed "sides" include both interior and exterior sides.

Claim 3 is dependent on claim 1 and requires that the edge detecting means determines the edge to be between pixels. The Examiner relies on Figs. 1 and 8 of Kuwata et al. Fig. 1 shows the image processor as comprising four units. The Examiner has not explained which unit discloses the feature of claim 3. As for Fig. 8, this figure shows a graph of the relationship

between f(x), f(y) and G(x,y). The Examiner has not explained how and why this graph discloses an edge detecting means and that the means determines the edge between pixels. The Examiner further relies on the disclosure at col. 10, lines 5-39 of Kuwata et al., which states:

> At step **S110**, the edge amount of the each pixel is judged. In case of considering an XY rectangular coordinates as shown in FIG. **8**, the vector of a image change level can be calculated by obtaining an X-axis directional component and a Y-axis directional component. In a digital image composed of pixels in dot matrix, the pixels are adjacent to each other in a vertical axial direction and a lateral axial direction as shown in FIG. **9**. The brightness of these pixels are represented by f(x,y). In this case, f(x,y) may be R(x,y), G(x,y) and B(x,y) as respective RGB luminances or a total luminance Y(x,y). Note that the relation between the RGB luminances R(x,y), G(x,y) and B(x,y) and the total luminance Y(x,y) cannot be converted without referring to a color conversion table or the like, in the strict sense, however, for the simplification of the processing, the correspondence as represented by the following equation is utilized.
>
> $$Y = 0.30R + 0.59G + 0.11B \qquad (1)$$
>
> In FIG. 9, the X-directional difference value fx and the Y-directional difference value fy are represented by:
>
> $$fx = f(x+1,y) - f(xy) \qquad (2)$$
>
> $$fy = f(x,y+1) - f(xy) \qquad (3)$$
>
> Accordingly, a size g(x,y) of the vector having these components is a vector value represented by:
>
> $$[g(x,y)] = (fx**2+fy**2)**(1/2) \qquad (4)$$
>
> The edge amount is represented by this [g(x,y)]. Note that the pixels are arranged into matrix in the vertical and lateral directions as shown in FIG. **10**, and when the central pixel is regarded as a pixel of interest, there are eight adjacent pixels.

This disclosure does not address the edge detecting means and that the means determines the edge between pixels. The disclosure does not even refer to the edges of the pixels. The

Examiner has not provided any cogent reasoning as to how this disclosure meets this feature of claim 3.

Claim 4 is dependent on claim 1 and recites that the selecting means selects the weighting matrix based on the presence or absence of an edge of a target pixel in four directions surrounding the target pixel. For this feature of the invention, the Examiner relies on Fig. 8 and col. 10, lines 5-42 of Kuwata et al. The disclosure at col. 10, lines 5-39 is reproduced *supra* in the previous paragraph. The following is the disclosure at col. 10, lines 39-42:

> Accordingly, it may be arranged such that the differences between the pixel of interest and the respective adjacent pixels are represented by vectors, and the sum of the vectors is judged as the change level of the image.

Fig. 8 is a graph and does not make any reference to "four directions surrounding the target pixel." Moreover, the Examiner has not presented any cogent reasoning from the disclosure at col. 10, lines 5-42 of the Kuwata et al. as how the figure would disclose the feature of the invention recited in claim 4. The disclosure does not refer to the weighting matrix based on the presence or absence of an edge of a target pixel, let alone that that it is based on four directions surrounding the target pixel.

In the Advisory Action, the Examiner finds that claim 4 "can be interpreted as selecting a weighting matrix in four directions based on whether it is an edge or not." Despite the Examiner's position, the claim is clear, the weighting matrix is selected <u>based on the presence or absence of an edge in four directions</u>, and not on whether the target pixel has an edge. Kuwata et al. does not teach or suggest this weighting effect recited in claim 4. In Kuwata et al., the weight is applied equally to each of the pixels contiguous with each edge of the target pixel.

Claim 6 is dependent on claim 1 and requires that the edge enhancing means executes processing based on the distance of the object pixel to the target pixel. For this feature, the Examiner relies on Figs. 7 and 16, and the disclosures at col. 11, lines 14-31 and col. 12, lines 11-34 of Kuwata et al., which state:

> ... More specifically, at step **S120**, the edge amount is compared with a predetermined threshold value to determine whether or not the pixel belongs to an outline portion. Only if the pixel belongs to an outline portion, the process proceeds to step **S130**, in which the edge amount is integrated, and the number of pixels in the outline portions is integrated.
>
> To perform the pixel-based judgment on all the pixels, at step **S140**, the position of pixel of interest is moved as shown in FIG. **7**, and the processing is repeated until it is determined at step **S150** that the judgment on all the pixels has been completed.
>
> When the edge amounts have been summed up as above, edge-enhancement element determination is performed at step **S200**. The edge-enhancement element determination is shown in more detail in the flowchart of FIG. **14**.
>
> First, at step S **210**, the ratio of edge pixels is calculated. As the number of outline pixels (edge_pixel) has been integrated at step **S 130**, the ratio of the number of outline pixels (edge_rate) with respect to the number of all the pixels (total_pixel) is calculated:
>
> Edge_rate = edge_pixel/total_pixel
>
> * * *
>
> On the other hand, as image sharpness is sensuous, the sharpness level SL is obtained in a similar manner from image data of an experimentally-obtained optimum sharpness level, then the obtained sharpness level SL is set as an ideal sharpness level SLopt, and an edge enhancement level Eenhance is obtained by:
>
> Eenhance = $KS \bullet (SL\text{opt}-SL)^{**}(1/2)$ (6)
>
> In equation (6), the coefficient KS changes in accordance with image size. As shown in FIG. **7**, if the image data is composed of "height" dots in the vertical

> direction and "width" dots in the lateral direction, the coefficient KS is obtained by:
>
> $$KS = \min(\text{height},\text{width})/A \qquad (7)$$
>
> In equation (7) , "min (height, width)" indicates "height" dots or "width" dots as a smaller number of dots. "A" is a constant having a value "768". They have been experimentally obtained and may be appropriately changed. Basically, excellent results have been obtained by increasing the enhancement level as the image size becomes greater.

The comparison as discussed by Kuwata et al. in the above disclosure appears to be a comparison of the pixel of interest to pixels in its immediate surroundings, and not by distance between pixels, because the reference discloses that "the process proceeds to step **S130**, in which the edge amount is integrated, and the number of pixels in the outline portions is integrated" and if necessary the pixel is moved. Equations (6) and (7) discuss coefficient KS in terms of height and width, but these terms mean the number of dots in the height and width directions, and not the distances between an object pixel and a target pixel. The Examiner has not presented any cogent reasoning as to how and why the passage above teaches the feature set forth in claim 6.

In the Advisory Action, the Examiner finds that Figs. 18-20 of Kuwata et al. disclose "the relationship of the weight applied depending on the distance away from the target pixel." The Examiner points to col. 13, lines 29-38 to support her position. This portion of the Kuwata et al. disclosure indicates that the weighting gradually decreases with respect to peripheral pixels further away from the target pixel. Claim 6, however, is directed to reciting that the execution of enhancing processing based on the distance of the object pixel from the target pixel. The enhancement processing is not based on weighting factors, but the use of enhancement parameters as illustrated in Tables 1 and 2 on pages 13 and 14 of the specification.

As for independent method claim 7 and medium readable claim 9 as well as claim 8 which is dependent on claim 7, the arguments made with respect to claims 1 and 2, *supra*, apply to these claims and are incorporated herein by reference. In finding claim 9 unpatentable, the Examiner states that "[a] recording medium that stores computer executable programs in inherently taught as evidenced by computer main body 21 and various memories stored therein." The Examiner relies on computer **21** as having virtual memories. However, for reasons already given, *supra*, Kuwata et al. do not disclose the program steps set forth in claim 9. Claim 11 is an independent claim directed to an apparatus and requires elements similar to those set forth in claim 1. The arguments made with respect to claim 1 apply to claim 11 and are incorporated herein by reference.

Conclusion

For all of the foregoing reasons, Appellant respectfully submits that the grounds of rejection of the claims on appeal is in error and should be reversed.

Respectfully submitted,

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CLAIMS APPENDIX

Claim 1: An image processing apparatus, comprising:

edge detecting means for determining the presence/absence of an edge at each pixel of input data and detecting a position of the edge at each edge pixel;

selecting means for selecting a weighting matrix corresponding to the position of the edge of each target pixel determined to have an edge by said edge detecting means;

enhancement range determining means for determining, using said weighting matrix, a range of edge enhancement of each said target pixel determined to have an edge; and

edge enhancing means for executing an edge enhancement process on data of object pixels within the enhancement range determined by said enhancement range determining means.

Claim 2: An image processing apparatus according to claim 1, wherein said enhancement range determining means increases the weighting of components corresponding to the interior side of the edge in the weighting matrix.

Claim 3: An image processing apparatus according to claim 1, wherein said edge detecting means determines the edge to be between pixels.

Claim 4: An image processing apparatus according to claim 1, wherein said selecting means selects the weighting matrix based on the presence/absence of an edge in four directions surrounding the target pixel.

Claim 5: An image processing apparatus according to claim 1, wherein said edge enhancing means executes processing based on the hue and chroma of the pixels surrounding the object pixel.

Claim 6: An image processing apparatus according to claim 1, wherein said edge enhancing means executes processing based on the distance of the object pixel to the target pixel.

Claim 7: An image processing method, comprising the steps of:

determining the presence/absence of an edge at each pixel of input image data;

selecting a weighting matrix corresponding to the position of the edge for each target pixel determined to have an edge;

determining, using said weighting matrix, a range of edge enhancement for each said target pixel determined to have an edge; and

executing an edge enhancement process for the object pixels within the determined edge enhancement range.

Claim 8: An image processing method according to claim 7, wherein the weighting of components corresponding to the interior side of the edge in the weighting matrix is increased in the step of determining the range.

Claim 9: A medium readable by a computer storing computer-executable programs comprising the steps of:

determining the presence/absence of an edge at each pixel of input image data;

selecting a weighting matrix corresponding to the position of the edge for each target pixel determined to have an edge;

determining, using said weighting matrix, a range of edge enhancement for each said target pixel determined to have an edge; and

executing an edge enhancement process for the object pixels within the determined edge enhancement range.

Claim 11: An image processing apparatus, comprising:

an edge detector for determining the presence/absence of an edge at each pixel of input data and detecting a position of the edge at each edge pixel;

a selector for selecting a weighting matrix corresponding to the position of the edge of each target pixel determined to have an edge by said edge detecting means; and

a controller configured to determine, using said weighting matrix, the range of edge enhancement of each said target pixel determined to have an edge;

said controller further configured to execute an edge enhancement process on data of object pixels within the enhancement range determined by said enhancement range determining means.

Evidence Appendix

NONE

Related Proceedings Appendix

NONE